

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**



(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 92309501.2

(51) Int. Cl.⁵: B27G 19/02, H01H 13/08

(22) Date of filing: 16.10.92

(30) Priority: 18.10.91 JP 299691/91

(43) Date of publication of application: 21.04.93 Bulletin 93/16

(84) Designated Contracting States: DE FR GB

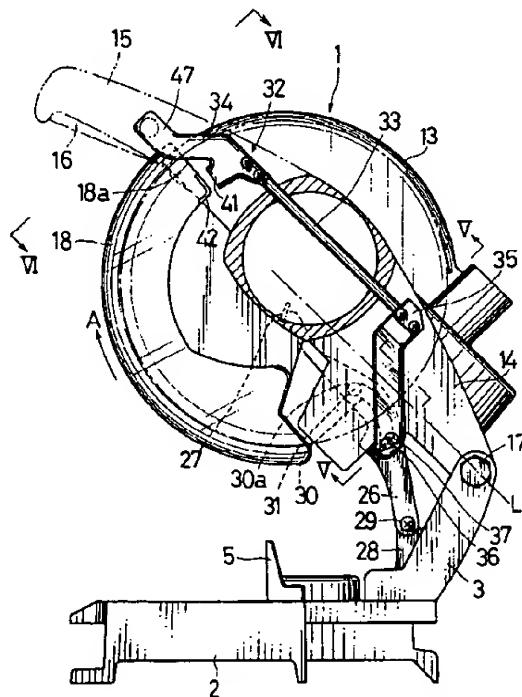
(71) Applicant: MAKITA CORPORATION
11-8 Sumiyoshi-cho 3-chome
Anjo-shi, Aichi-ken (JP)

(72) Inventor: Sasaki, Katsuhiko, c/o Makita Corporation
11-8, Sumiyoshi-cho, 3-chome
Anjo-shi, Aichi-ken (JP)
Inventor: Shibata, Yohinori, c/o Makita Corporation
11-8, Sumiyoshi-cho, 3-chome
Anjo-shi, Aichi-ken (JP)

(74) Representative: Senior, Alan Murray
J.A. KEMP & CO 14 South Square Gray's Inn
London WC1R 5EU (GB)

(54) Miter saw.

(57) A miter saw (1) includes a base (2) and a body (4) vertically pivotally mounted on the base (2). A saw blade (12) driven by a motor (6) is rotatably supported by the body (4). The body (4) includes a blade case (13) for partly covering the saw blade (12) and includes a safety cover (18) movable between a covering position to substantially cover the exposed part of the saw blade (12) and an uncovering position to uncover the exposed part of the saw blade (12). A lever mechanism (32) is disposed on the body (4) for preventing movement of the safety cover (18) from the covering position to the uncovering position. The lever mechanism (32) includes a lever member (34) operable between a first position to prevent movement of the safety cover (18) and a second position to permit movement of the safety cover (18).



F/G.2

The present invention relates to a miter saw.

A conventional miter saw includes a base and a body vertically pivotally mounted on the base. A motor is mounted on the body for driving a circular saw blade. The body includes a blade case partly covering the saw blade. A safety cover is mounted on the blade case for covering a part of the saw blade which is exposed from the blade case. The safety cover is movable to uncover the exposed part of the saw blade for cutting operation by the saw blade. A mechanism may be provided for moving the safety cover to uncover the exposed part of the saw blade as the body is pivoted downwardly from the uppermost position where the exposed part of the saw blade is completely covered by the safety cover. The mechanism may utilize gravity of the safety cover itself or include a link mechanism interlocked with the safety cover for moving the safety cover to uncover the part of the exposed saw blade as the body is moved downwardly from the uppermost position.

With such a miter saw, it has been proposed to provide a lock device for keeping the body at the uppermost position for safety purpose when the miter saw is not operated. Japanese Utility Model Publication No. 62-5289, Japanese Patent Publication No. 60-71113 and DE-OS 31 19 573 disclose a lock device which directly secures a body of a miter saw to a base.

Although the prior art lock device can maintain the miter saw at an uppermost position, it cannot maintain a safety cover itself at a position to cover a saw blade. Therefore, it may accidentally cause the safety cover to be moved to uncover the exposed part of the saw blade.

It is, accordingly, an object of the present invention to provide a miter saw which can reliably prevent a safety cover from accidentally moving to uncover a saw blade.

According to the present invention, there is provided a miter saw comprising a base and a body vertically pivotally mounted on the base. A saw blade driven by a motor is rotatably supported by the body. The body includes a blade case for partly covering the saw blade and includes a safety cover movable between a covering position to substantially cover the exposed part of the saw blade and an uncovering position to uncover the exposed part of the saw blade. A lever mechanism is disposed on the body for preventing movement of the safety cover from the covering position to the uncovering position. The lever mechanism includes a lever member operable between a first position to prevent movement of the safety cover and a second position to permit movement of the safety cover.

The invention will be further described by way of non-limitative example with reference to the accompanying drawings, in which:-

FIG. 1 is a left side view of a miter saw according

to an embodiment of the present invention;

FIG. 2 is a right side view, with a part broken away, of the miter saw shown in FIG. 1;

FIG. 3 is a sectional view taken along line III-III in FIG. 1;

FIG. 4 is an enlarged view of a lock plate shown in FIG. 2;

FIGS. 5(A) and 5(B) are sectional views taken along line V-V in FIG. 2 and show different operations; and

FIGS. 6(A) and 6(B) are sectional views taken along line VI-VI in FIG. 2 and show different operations corresponding to FIGS. 5(A) and 5(B), respectively.

An embodiment of the present invention will be hereinafter explained with reference to the drawings. Referring to FIGS. 1 and 2, there is shown a miter saw 1 in a left side view and a right side view, respectively. The miter saw 1 includes a base 2 for supporting a work (not shown) thereon, an arm 3 fixed to the base 2 and extending upwardly therefrom, a body 4 pivotally mounted on the arm 3 in a vertical direction and a fence member 5 mounted on the base 2 for guiding the lateral surface of the work. The arm 3 is inclined rearwardly to some extent.

As shown in FIG. 3, the body 4 includes a motor housing 7 for accommodating a motor 6, a gear housing 10 accommodating a reduction gear 9 which is in engagement with a pinion 8a formed on a motor shaft 8 of the motor 6, and a blade case 13 partly accommodating a circular saw blade 12 which is detachably mounted on an output shaft 11 of the reduction gear 9. The blade case 13 includes a connecting portion 14 (see FIGS. 1 and 2) for connection with the arm 3.

A handle 15 extends outwardly from the motor housing 7 for vertical movement of the body 4 by an operator. The handle 15 includes a trigger 16 for operation of a switch (not shown) to start or stop the motor 6. The connecting portion 14 is pivotally connected to the arm 3 through a pin 17, so that the body 4 vertically pivots around the pin 17 by moving the handle 15. A spring (not shown) is interposed between the arm 3 and the connecting portion 14 for normally biasing the body 4 upwardly.

As shown in FIG. 3, the blade case 13 includes an opening 13a at a position opposite to the central portion of the saw blade 12. A mounting plate 19 for mounting a safety cover 18 on the blade case 13 is placed on the blade case 13 against the opening 13a. As shown in FIG. 1, the mounting plate 19 includes end portions substantially diametrically opposed to each other, one of which is pivotally supported by the blade case 13 through a screw 20 and the other of which is detachably mounted to the blade case 13 through a bolt 21.

The mounting plate 19 includes at its central portion an opening 19a for rotatably receiving a cap 22. A substantially fan-shaped safety cover 18 is secured

to the cap 22 through a screw 24 for covering a part of the saw blade 12 which is exposed to the outside from the blade case 13. A spiral spring 25 is interposed between the mounting plate 19 and the safety cover 18 for normally biasing the safety cover 18 in a direction to entirely cover the exposed part of the saw blade 12.

An abutting plate 27 is fixed to the rear surface of the cap 22 and is in abutment on an upper end of a link member 26 which controls the rotational position of the cap 22 or the safety cover 13. As shown in FIG. 1 or 2, a bracket 28 is fixed to a lower portion of the arm 3 and vertically upwardly extends therefrom. The link member 26 is pivotally mounted on an upper end of the bracket 28 through a pin 29. An elongated control slot 30 is formed on the central portion of the link member 26 and extends in a longitudinal direction thereof. The control slot 30 has substantially arc-shaped configuration. A roller pin 31 is mounted on the blade case 13 and is in engagement with the control slot 30. The upper portion of the control slot 30 is determined to have a smaller radius than the lower portion. Thus, as the body 4 is lowered from its uppermost position, the link member 26 is pivoted in response to the movement of the engaging position of the roller pin 31 with the control slot 30, and the cap 22 is rotated together with the safety cover 18 in a counterclockwise direction in FIG. 2 against the biasing force of the spring 25 through abutment of the upper end of the link member 26 with the abutting plate 27. Thus, the safety cover 18 is moved to uncover the exposed part of the saw blade 12.

A lever device 32 is disposed on the right side of the body 4 for securing the body 4 at the most upper position as shown in FIGS. 1 and 2 where the roller pin 31 engages an upper end 30a of the control slot 30 of the link member 32. As shown in FIG. 2, the lever device 32 includes a rod 33 displaced in parallel relationship from a central line L of the body 4 which extends through a central axis of the pin 17 or a pivotal axis of the body 4. A lever member 34 is connected to one end of the rod 33 and extends outwardly beyond the body 3 so as to protrude substantially in the same direction as the handle 15 at a position adjacent the handle 15. A lock plate 35 is fixed to the other end of the rod 33 and extends to intersect the link member 26.

The lock plate 35 includes at its lower portion a slot 37 for engagement with a lock pin 36 inserted into the connecting portion 14 of the body 4. As shown in FIG. 4, the slot 37 includes a circular portion 37a and an elongated portion 37b extending from the circular portion 37a in a direction substantially perpendicular to the rod 33.

As shown in FIG. 5(A), the connecting portion 14 of the body 4 includes side plates 14a and 14b opposed to each other. The side plates 14a and 14b include holes 38 and 39, respectively. The end portions

of the lock pin 36 are slidably inserted into the holes 38 and 39, respectively. A collar 40 having a larger diameter than the holes 38 and 39 is formed on a middle portion of the lock pin 36. The distance between the collar 40 and one end of the lock pin 36 on a side of the side plate 14b is slightly longer than the distance between the side plates 14a and 14b in such a manner that the one end of the lock pin 36 does not extend outwardly from the hole 39 when the collar 40 abuts on the side plate 14a as shown in FIG. 5(B).

The other end of the lock pin 36 includes a head 36b and a neck 36a. The neck 36a has a smaller diameter than the head 36b or the other portion of the lock pin 36 and is inserted into the elongated portion 37b of the slot 37 of the lock plate 35 with the head 36b engaged by the outer surface of the lock plate 35. The circular portion 37a of the slot 37 has a larger diameter than the head 36b of the lock pin 36 and serves as an insertion hole of the head 36b for mounting the lock pin 36 on the lock plate 35.

A compression spring 45 is interposed between an end portion of a connecting part 35a of the lock plate 35 and an outer surface of the blade case 13 opposed to the end portion of the connecting part 35. The connecting part 35a is formed to connect the rod 33 to the lock plate 35. The compression spring 45 biases the lock plate 35 in a direction to move the lock pin 36 toward the link member 26 or a clockwise direction in FIG. 5(A) around the rod 33. The blade case 13 includes a rib 46 for receiving the compression spring 45 and for preventing the compression spring 45 from being exposed to the outside.

The mounting position of the lock pin 36 on the connecting portion 14 of the body 4 is determined in such a manner that the lock pin 36 is opposed to the lower portion of the control slot 30 of the link member 36 and is permitted to engage the lower end of the control slot 30 by the biasing force of the compression spring 45 as shown in FIG. 5(A) when the body 4 is positioned at the uppermost position as shown in FIG. 2.

The lever member 34 connected to the upper end of the rod 33 includes a handle portion 47 prepared to be grasped by the operator. When the operator moves the lever member 34 at a position shown in FIG. 5(A) through the handle portion 47 in a direction laterally away from the blade case 13 so as to pivot the lock plate 35 against the biasing force of the compression spring 45, the lock pin 36 is removed from the control slot 30 as shown in FIG. 5(B).

As shown in FIG. 2, the lever member 34 further includes a stopper portion 41 which is bent from the lever member 34 perpendicular thereto and which is positioned adjacent one end 18a of the safety cover 18 in a rotational direction shown by the arrow A in FIG. 2 or a direction to uncover the exposed part of the saw blade 12 when the exposed part of the saw blade 12 is entirely covered by the safety cover 18.

The stopper portion 41 is opposed in the rotational direction of the safety cover 18 to the one end 18a of the safety cover 18 for preventing rotation of the safety cover 18 to uncover the exposed part of the saw blade 12 when the lock pin 36 is in engagement with the lower end of the control slot 30 of the link member 26 as shown in FIG. 5. On the other hand, the stopper portion 41 permits rotation of the safety cover 18 to uncover the exposed part of the saw blade 12 when the lock pin 36 is disengaged from the control slot 30. The one end 18a of the safety cover 18 includes an L-shaped part 42 having a larger thickness for abutment on the stopper portion 41.

The lever member 34 extends in the same direction as the handle 15 as described above. A lock-off button 43 is slidably mounted on the handle 15 and is movable to extend from and to retract into the handle 15. The lock-off button 43 is interlocked with the trigger 16 and is disposed at a position opposed to the handle portion 47 of the lever member 34 as shown in FIG. 6(A). The lock-off button 43 includes a shank 43a slidably supported by the handle 15, a head 43 having a larger diameter than the shank 43a and positioned outwardly of the handle 15, and a stopper plate 43c disposed within the handle 15 for engagement with a recess 15a formed on a part of the inner wall of the handle 15. A spring 44 is interposed between the stopper plate 43c and a part of the inner wall of the handle 15 opposed to the stopper plate 43c for normally biasing the lock-off button 43 to extend outwardly from the handle 15.

When the lock pin 36 is in engagement with the lower end of the control slot 30 of the link member 26 as shown in FIG. 5(A), the lever member 34 is spaced from the lock-off button 43. Therefore, the lock-off button 43 is maintained at a most extended position from the handle 15 where the stopper plate 43c is in engagement with the recess 15a as shown in FIG. 6(A). When the lever member 34 is moved to the position shown in FIG. 5B for removing the lock pin 36 from the control slot 30 of the link member 26, the head 43a of the lock-off button 43 is pressed by the lever member 34 and the lock-off button 43 is retracted into the handle 15 against the force of the spring 44 until the head 43a abuts on the outer surface of the handle 15.

The trigger 15 is of substantially U-shaped configuration in section to form a recess 16a for receiving a part of the stopper plate 43c of the lock-off button 43. When the lock-off button 43 is positioned at the retracting position as shown in FIG. 6(A), the stopper plate 43c is faced to an end surface 16b of the trigger 16 forming an inlet of the recess 16a so as to prevent the trigger 16 from moving into the handle 15. When the lock-off button 43 is positioned at the extending position as shown in FIG. 6(B), the stopper plate 43c is faced to the recess 16a of the trigger 16 so as to permit the trigger 16 to move into the handle 15 for

starting the motor 6.

The operation of the above embodiment will now be described. When the body 4 of the miter saw 1 is positioned at the uppermost position as shown in FIGS. 1 and 2, the lock pin 36 is in engagement with the lower end of the control slot 30 of the link member 26 as shown in FIG. 5(A). At this situation, the lock pin 36 cooperates with the roller pin 31 engaged with the upper portion 30a of the control slot 30 so as to fix the link member 26 in position and to maintain the body 4 at the uppermost position. Since the link member 26 is thus fixed in position, the safety cover 18 is prevented from rotation in a direction to uncover the exposed part of the saw blade 12. Additionally, at this situation, the stopper portion 41 of the lever member 34 is in opposed relationship with the end portion 18a of the safety cover 18 in the rotational direction of the safety cover 18 as shown in FIG. 6(A), and therefore, the safety cover 18 is further prevented from rotation to uncover the exposed part of the saw blade 12. Further, at this situation, the stopper plate 43b of the lock-off button 43 is faced to the end surface 16b of the trigger 16, and therefore, the trigger 16 is prevented from moving into the handle 15 for starting the motor 6.

As the lever member 34 is moved away from the blade case 13 against the force of the compression spring 45, the lock pin 36 is disengaged from the control slot 30 of the link member 26 as shown in FIG. 5(B), and simultaneously therewith, the stopper portion 41 of the lever member 34 is moved laterally away from the end portion 18a of the safety cover 18 as shown in FIG. 6(B). This may permit downward pivotal movement of the body 4 by moving the handle 15, and may permit the rotational movement of the safety cover 18 in a direction to uncover the exposed part of the saw blade 12 (a reverse direction to the direction shown by the arrow A in FIG. 2). Further, as the lever member 34 is thus moved laterally, the handle portion 47 pushes the lock-off button 43 into the handle 15 through abutment on the head 43b of the lock-off button 43. Thus, the trigger 16 is allowed to be pushed into the handle 15 for starting the motor 6 through entering of the part of the stopper plate 43c into the recess 16a.

At this stage, as the operator moves the body 4 downwardly by the handle 15, the link member 26 is pivoted in response to the movement of the engaging position of the roller pin 31 with the control slot 30 of the link member 26. As the link member 26 is thus pivoted, the safety cover 18 is rotated in the direction shown by the arrow A in FIG. 2 to uncover the exposed part of the saw blade 12.

Once the body 4 is moved downwardly from the uppermost position, the lock pin 36 may not enter the control slot 30 but abuts on the rear surface of the link member 26 by the biasing force of the compression spring 45 because of the pivotal movement of the link

member 26 even if the operator releases the lever member 34. Thus, the position of the lever member 34 as well as that of the lock plate 35 is kept at the position as shown in FIGS. 5(B) and 6(B). Therefore, the pivotal movement of the body 4 as well as the rotational movement of the safety cover 18 to uncover the saw blade 12 can be performed without any trouble, and the trigger 16 can be pushed into the handle 15 to start the motor 6 for cutting the work by the saw blade 12.

After completion of cutting operation of the work, the handle 15 is released to permit upward movement of the body 4 toward the uppermost position by the spring interposed between the arm 3 and the connecting portion 14. When the body 4 reaches the uppermost position, the lock pin 36 automatically returns to engage the control slot 30 of the link member 26 by the force of the compression spring 45. Thus, the lever mechanism 32 returns to the position as shown in FIGS. 5(A) and 6(A).

Thus, with the above embodiment, the lever mechanism 32 serves to fix the body 4 at the uppermost position and to fix the safety cover 18 at the position to entirely cover the exposed part of the saw blade 12 so as to prevent accidental exposure of the saw blade 12. Therefore, the miter saw 1 has a simple construction since it is not necessary to provide a lock mechanism for each of the body 4 and the safety cover 18.

In addition, the position of the link member 26 is reliably fixed through engagement of the lock pin 36 with the control slot 30 of the link member 26. Further, since the lock pin 36 is automatically engaged with the control slot 30 when the body 4 reaches the uppermost position, the lever device 32 can be easily operated.

While the invention has been described with reference to a preferred embodiment, it is to be understood that modifications or variation may be easily made without departing from the spirit of this invention which is defined by the appended claims.

Claims

1. A miter saw (1) comprising a base (2), a body (4) vertically pivotally mounted on said base (2) and rotatably supporting a saw blade (12) driven by a motor (6), said body (4) including a blade case (13) for partly covering said saw blade (12) and including a safety cover (18) movable between a covering position to substantially cover the exposed part of said saw blade (12) and an uncovering position to uncover the exposed part of the saw blade (12); characterized in that lever means (32) is disposed on said body (4) for preventing movement of said safety cover (18) from said covering position to said uncovering position, and

5 that said lever means (32) includes a lever member (34) operable between a first position to prevent movement of said safety cover (18) and a second position to permit movement of said safety cover (18).

10 2. The miter saw as defined in claim 1 and further including means provided between said base (2) and said safety cover (18) for moving said safety cover (18) from said covering position to said uncovering position in response to downward movement of said body (4) from an uppermost position.

15 3. The miter saw as defined in claim 2 wherein said means for moving said safety cover (18) includes a link member (26) interposed between said base (2) and said safety cover (18); said lever means (32) includes a lock member (35, 36) connected to said lever (34); and said lock member (35, 36) fixes the position of said link member (26) when said body (4) is positioned at said uppermost position and said lever member (34) is positioned at said first position.

20 4. The miter saw as defined in claim 3 wherein said link member (26) includes a control slot (30) in engagement with a guide pin (31) fixed to said body (4); said lock member (35, 36) includes a lock pin (36) for engagement with said control slot (30) at a position different from the engaging position of said guide pin (31); and said lock pin (36) cooperates with said guide pin (31) for preventing movement of said link member (26).

25 5. The miter saw as defined in claim 3 or 4 and further including biasing means (45) for normally maintaining said lever member (34) at said first position and for keeping engaging position of said lock member (35, 36) with said link member (26).

30 6. The miter saw as defined in claim 4 wherein said lock pin (36) is slidably supported by said body (4).

35 7. The miter saw as defined in any one of claims 1 to 6 wherein said lever member (34) includes a stopper portion (41) which is opposed to a part of said safety cover (18) in a direction to uncover the exposed part of said saw blade (12) when said lever member (34) is positioned at said first position.

40 8. The miter saw as defined in any one of claims 1 to 7 wherein said body (4) includes a trigger (16) and a trigger lock device (43, 44) mounted on a part of said body (4); said trigger (16) is operable by an operator for starting and stopping said motor (6); said trigger lock device (43, 44) is operable

to selectively fix said trigger (16) at a position for stopping said motor (6); said lever member (34) is interlocked with said trigger lock device (43, 44) in such a manner that said trigger lock device (43, 44) operates to fix said trigger (16) to said position for stopping said motor (6) when said lever member (34) is positioned at said first position and that said trigger lock device (43, 44) permits said trigger (16) to be operated for starting said motor (6) when said lever member (34) is at said second position. 5 10

9. The miter saw as defined in claim 8 wherein said trigger lock device (43, 44) includes a lock-off button (43) mounted on said part of said body (4) and movable between an extending position to extend from said part of said body (4) toward said lever member (34) and a retracting position to retract into said part of said body (4); said lock-off button (43) is normally biased by a spring (44) in a direction toward said extending position; said lock-off button (43) at said extending position fixes said trigger (16) to said position for stopping said motor (6) when said lock-off button (43) is positioned at said extending position; said lock-off button (43) at said retracting position permits said trigger (16) to be moved for starting said motor (6); said lever member (34) at said first position is spaced from said lock-off button (43); and said lever member (34) moves said lock-off button (43) from said extending position to said retracting position when said lever member (34) is moved by the operator from said first position to said second position. 15 20 25 30 35

10. The miter saw as defined in claim 8 or 9 wherein said part of said body (4) having said trigger lock device (43, 44) is a handle (15) operable by the operator for vertically moving said body (4) relative to said base (2). 40

45

50

55

6

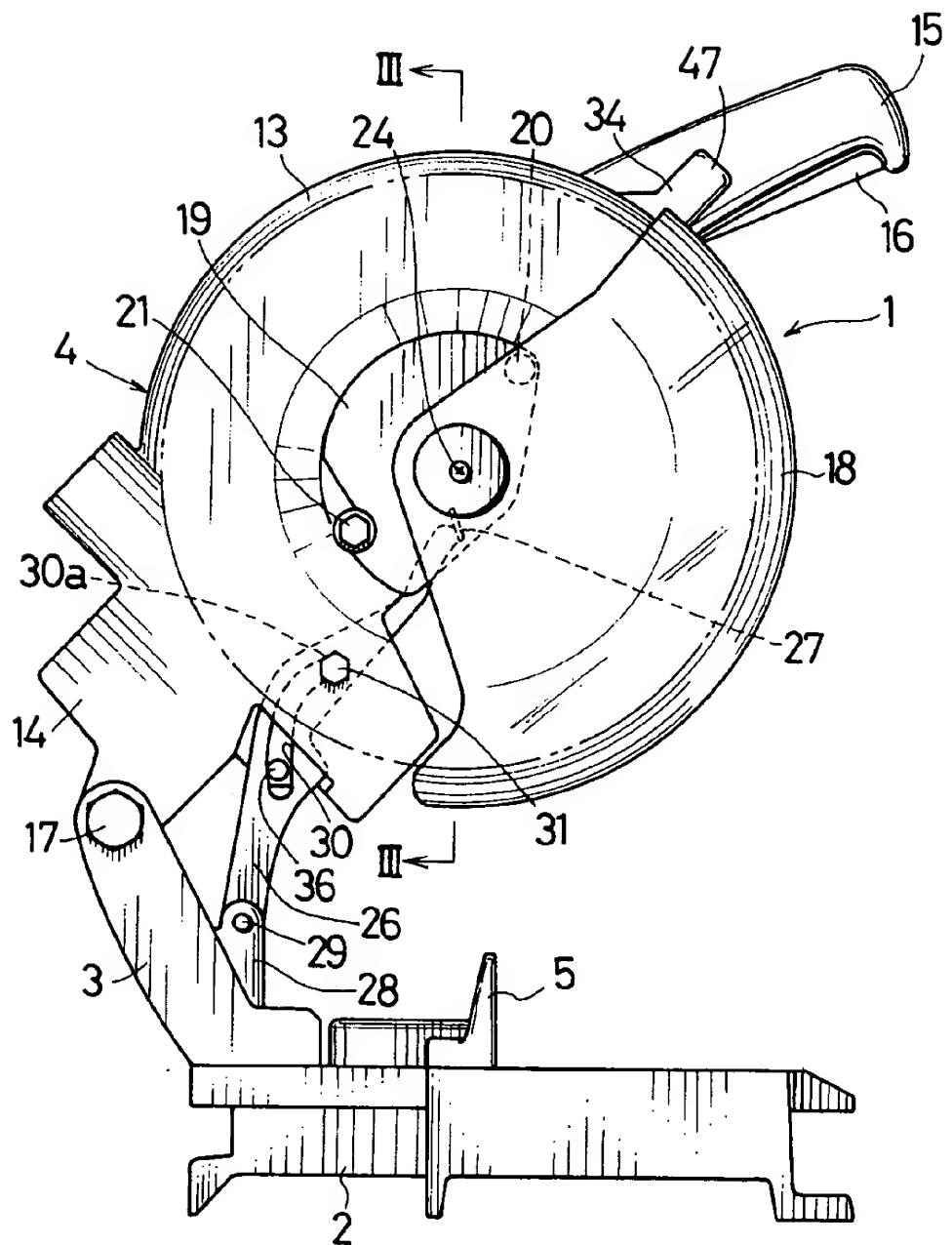
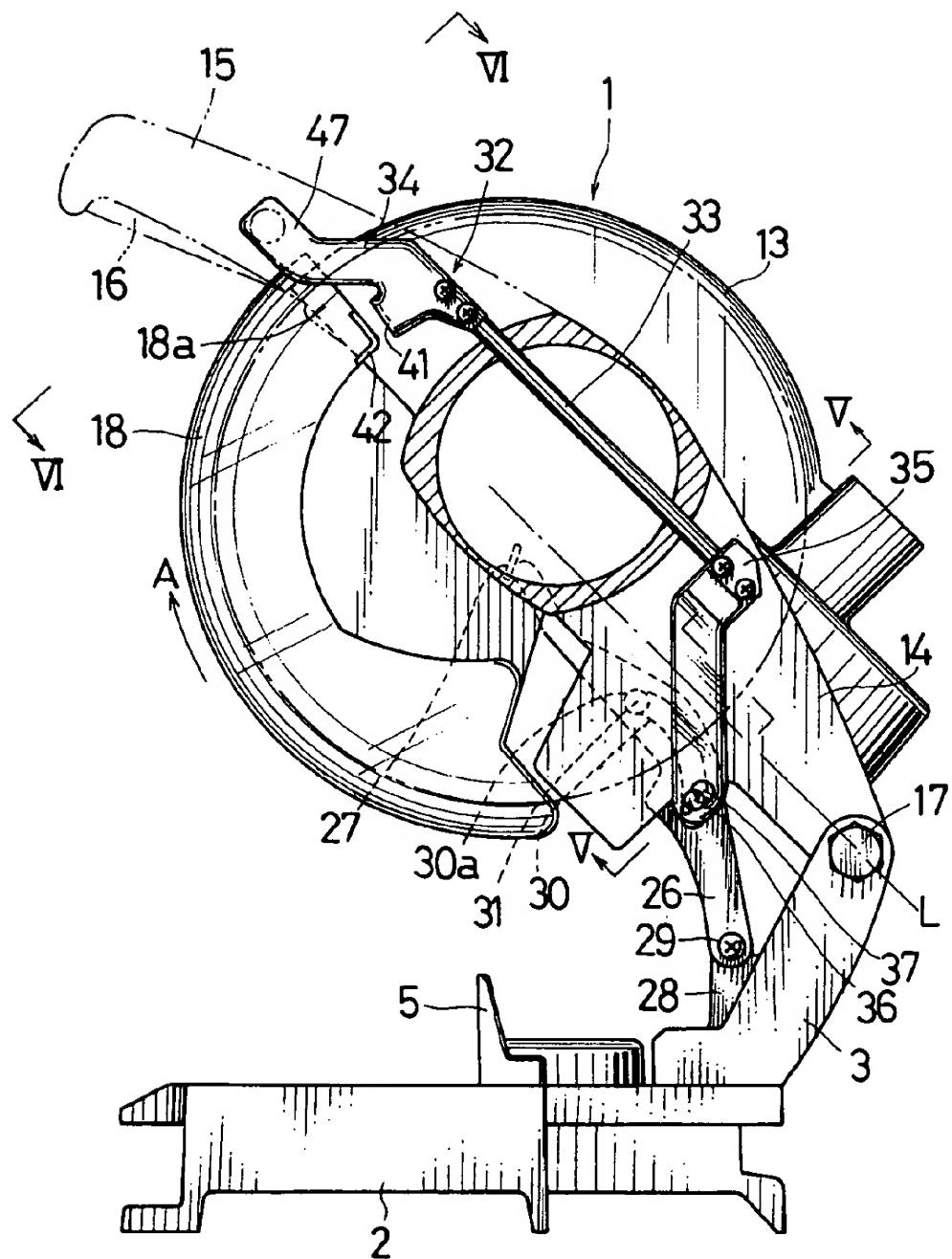


FIG. 1



F/G.2

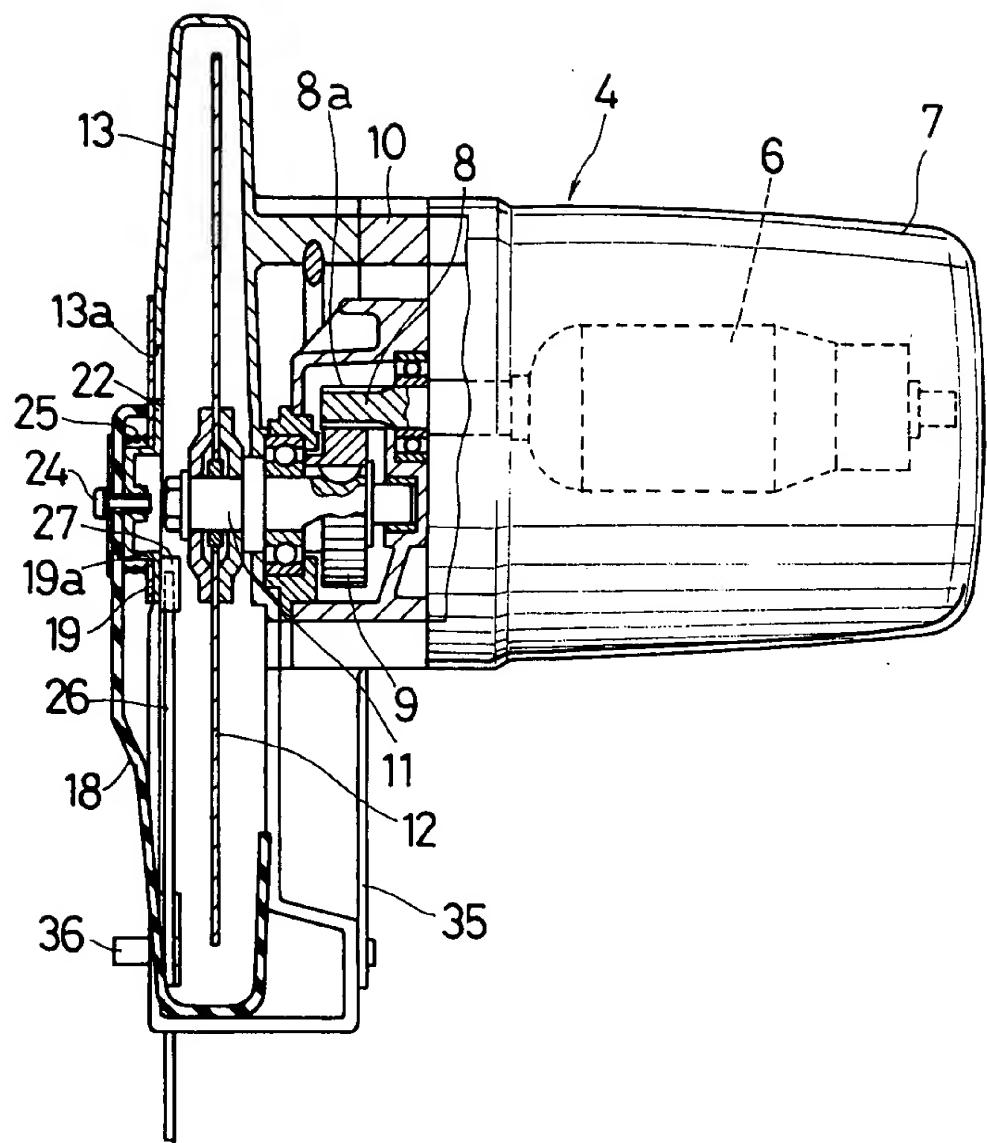


FIG. 3

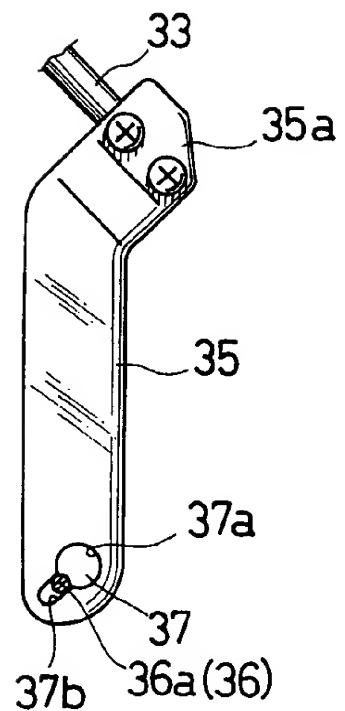
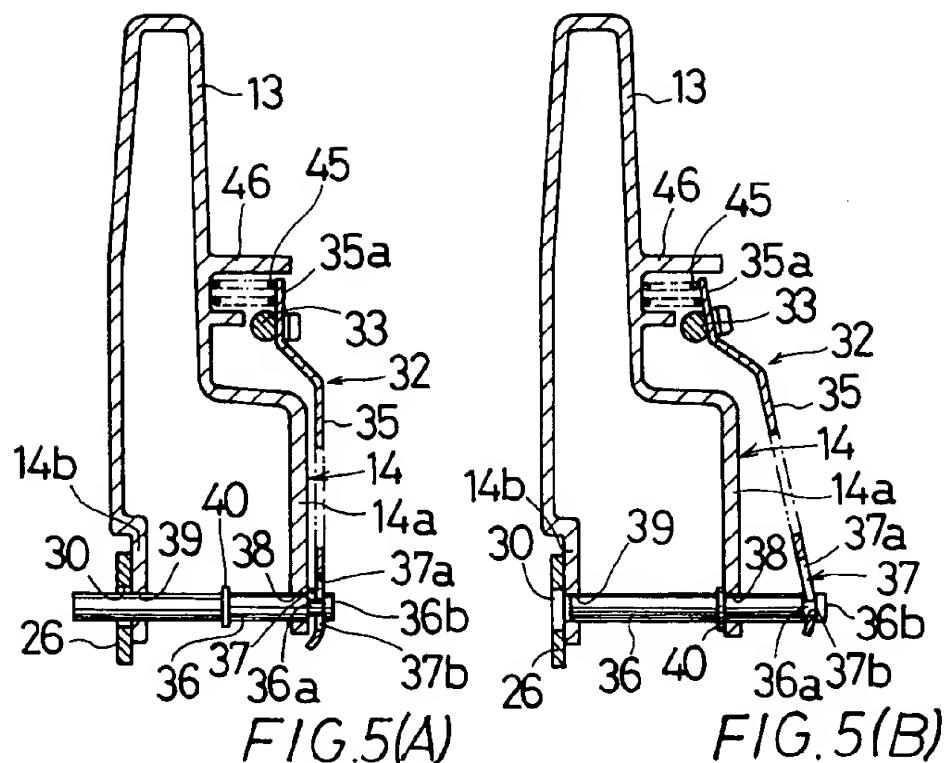


FIG. 4



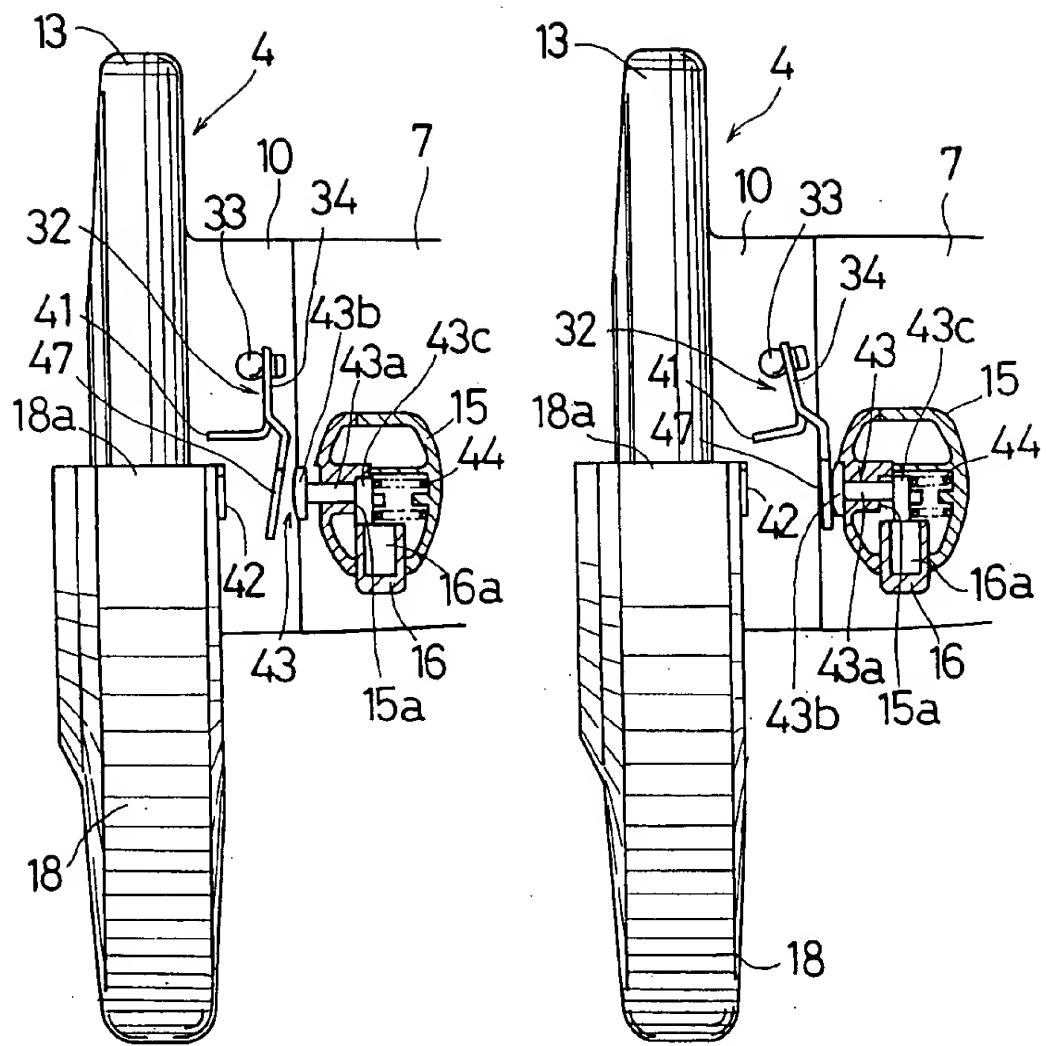


FIG. 6(A)

FIG. 6(B)



EUROPEAN SEARCH REPORT

Application Number

EP 92 30 9501

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	EP-A-0 450 400 (ELEKTRA-BECKUM LUBITZ) * column 3, line 23 - column 3, line 37 * * column 3, line 47 - column 4, line 7; figure *	1,2,7	B27G19/02 H01H13/08
Y	---	3-5,8-10	
A	---	6	
D, Y	DE-A-3 119 573 (HANNING ELEKTRO-WERKE) * page 5, line 2; figures 1,2 *	3,4,5	
A	US-A-3 177 909 (LAUBE) * column 2, line 45 - column 3, line 14; figures 1,3-6 *	6	
Y	DE-A-3 104 733 (REICH) * the whole document *	8-10	
A	US-A-1 900 553 (HAMPTON) * page 1, line 29 - line 38 * * page 1, line 99 - page 2, line 12 * * page 4, line 82 - page 5, line 16 * * page 5, line 93 - line 103; figures 1-3 *	8	
A	US-A-4 805 504 (FUSHIYA)	-----	B27G H01H
The present search report has been drawn up for all claims			
Place of search THE HAGUE	Date of compilation of the search 26 JANUARY 1993	Examiner HUGGINS J.D.	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background G : non-written disclosure P : intermediate document			